

WHAT IS CLAIMED:

1. An organic light-emitting device comprising:

a transparent substrate;

an anode layer;

a cathode layer;

organic functional layers sandwiched between the anode layer and the cathode layer;

and

an encapsulation layer fabricated on one side or both sides of the device;

wherein,

the encapsulation layer includes a thin multilayer structure which has a period number (n) of alternating layers formed of a polymer material layer and a ceramic material layer;

the encapsulation layer also includes a thick organic insulation layer on top of the thin multilayer structure, which is made up of polymer materials.

2. The organic light-emitting device of claim 1, wherein the substrate of the device includes one of glass and plastic.

3. The organic light-emitting device of claim 1, wherein the period number of the thin multilayer structure is an integer in the range of 1 to 10.

4. The organic light-emitting device of claim 1, wherein the polymer material layers in the thin film structure include one polymer selected from the group consisting of poly(methyl methacrylate), poly(ethyl methacrylate), and UV curable resins.

5. The organic light-emitting device of claim 4, wherein the polymer material layers in the thin film structure are in the range of about 50 to 1000 nm in thickness.

6. The organic light-emitting device of claim 1, wherein the ceramic material layers in the thin film structure include one material selected from the group consisting of nitrides, oxides, and nitrogen oxides.

7. The organic light-emitting device of claim 6, wherein the ceramic material layers in the thin film structure are in the range of about 10 to 1000 nm in thickness.

8. The organic light-emitting device of claim 6, wherein the ceramic material layers in the thin film structure include one material selected from the group consisting of silicon nitride, aluminum nitride, titanium nitride, silicon oxide, aluminum oxide, titanium oxide, silicon nitrogen oxide, aluminum nitrogen oxide and titanium nitrogen oxide.

9. The organic light-emitting device of claim 1, wherein the thick organic insulation layer in the encapsulation layer includes UV curable resins.

10. The organic light-emitting device of claim 9, wherein the thick organic insulation layer in the encapsulation layer is in the range of about 10 to 1000 µm in thickness.

11. A method for encapsulating an organic light-emitting device comprising the steps:

a) depositing a thin liquid monomer layer on one side of the organic light-emitting device by means of vacuum evaporation;

b) polymerizing the thin liquid monomer layer in situ to form a flat solid polymer thin film by ultraviolet light irradiation;

c) further depositing a ceramic thin film onto the polymer thin film;

d) subsequently fabricating n-1 periods of alternating thin layers formed of a layer of polymer and a layer of ceramic by repeating the above steps a), b), and c) n-1 times onto the ceramic thin film;

e) fabricating a thick liquid monomer layer by a doctor blade method on top of the alternating thin layers formed of polymer thin films and ceramic thin films; and

f) polymerizing the thick liquid monomer layer in situ to form a flat thick organic insulation film by ultraviolet light irradiation.

12. The method of claim 11, further comprising the step of:

g) fabricating an encapsulation layer on the other side of the organic light-emitting device by repeating the steps from a), b), c), d), e) and f).

13. The method of claim 11, wherein the organic light-emitting device has a substrate including one of glass and plastic.

14. The method of claim 11, wherein the period number n of the alternating thin layers is an integer in the range of 1 to 10.

15. The method of claim 11, wherein the polymer thin films in the alternating thin layers include one polymer selected from the group consisting of poly(methyl methacrylate), poly(ethyl methacrylate) and UV curable resins.

16. The method of claim 15, wherein the polymer thin films in the alternating thin layers are in the range of about 50 to 1000 nm in thickness.

17. The method of claim 11, wherein the ceramic thin films in the alternating thin layers include one material selected from the group consisting of nitrides, oxides, and nitrogen oxides.

18. The method of claim 17, wherein the ceramic thin films in the alternating thin layers are in the range of about 10 to 1000 nm in thickness.

19. The method of claim 17, wherein the ceramic thin films in the alternating thin layers include one material selected from the group consisting of silicon nitride, aluminum nitride, titanium nitride, silicon oxide, aluminum oxide, titanium oxide, silicon nitrogen oxide, aluminum nitrogen oxide and titanium nitrogen oxide.

20. The method of claim 11, wherein the thick organic insulation film in the encapsulation layer includes UV curable resins.

21. The method of claim 20, wherein the thick organic insulation film in the encapsulation layer is in the range of about 10 to 1000 μm in thickness.

22. A method for improving the performance of a plastic substrate, comprising the steps:

a) depositing a thin liquid monomer layer on the plastic substrate by means of vacuum evaporation;

- b) polymerizing the thin liquid monomer layer in situ to form a flat solid polymer thin film by ultraviolet light irradiation;
- c) further depositing a ceramic thin film onto the polymer thin film;
- d) subsequently fabricating $n-1$ periods of alternating thin layers formed of a layer of polymer and a layer of ceramic by repeating the above steps a), b), and c) $n-1$ times onto the ceramic thin film;
- e) fabricating a thick liquid monomer layer by a doctor blade method on top of the alternating thin layers formed of polymer thin films and ceramic thin films; and
- f) polymerizing the thick liquid monomer layer in situ to form a flat thick organic insulation film by ultraviolet light irradiation.